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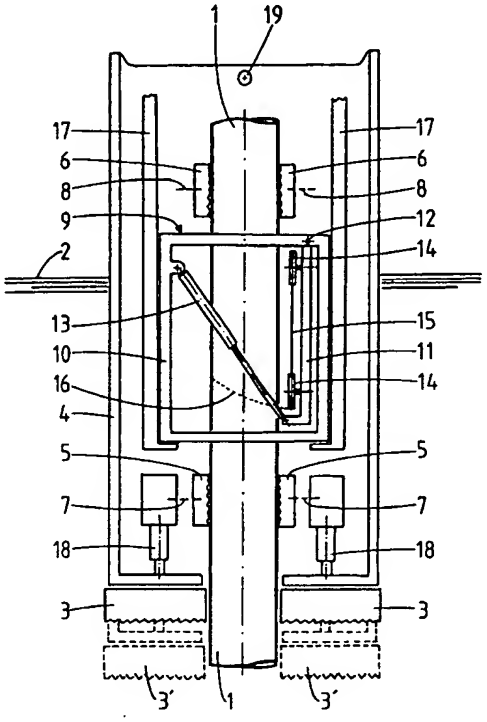
(54) Method and apparatus for removing the uppermost part of a construction in the seabed

(57) When removing the uppermost part of a construction in the seabed a drilling device is applied around said construction in the seabed. Using said drilling device a drill hole is made in the seabed to a certain depth around the construction. Next a cutting device is lowered in said drill hole and cuts said construction at the desired depth from the outside. Next the part of the construction cut loose can be removed together with the drilling device and the cutting device.



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Description

The invention firstly relates to a method for removing the uppermost part of a construction in the seabed, such as well heads, drilling rig legs and alike.

As a remainder of gas fields and oil fields a large number of constructions is present at the seabed, such as shut off well heads and partially removed drilling rig legs. These well heads and drilling rig legs have to be prepared in such a way that they constitute no obstacle to shipping and fishermen. Thus in many countries legislation requires that said constructions are to be removed up to a certain depth below the seabed, for example up to a depth of about 6 meters.

At this very instant two methods are known for removing such constructions. According to a first known method the uppermost part of the construction is released from a part of the construction remaining in the seabed using explosive charges applied in the construction. In a different known method separating the uppermost part of the construction from the lowermost part remaining in the seabed occurred by means of a cold cutting method using high pressure water with additives (so called "abrasive jet-cutting").

A common feature of the known methods is that these operate from inside the construction. These methods are well applicable if in the respective constructions no obstacles are present (such as closing devices or concrete or cement plugs in a well head). If however in a well head of a deserted gas or oil well a closing device ("corrosion cap") is provided these methods are not applicable, whereas at the other hand it is not always known exactly whether such a closing device is provided and at what depth.

Futher there is a risk that, especially when using explosive charges, closing devices, if applied, are damaged such that unwantedly residual gas or residual oil can flow into the surrounding of the well head and can lead to environmental pollution.

The above mentioned problems did lead to the conclusion that on a global scale about 30 % of particularly well heads do not allow the removal of the uppermost part using the known methods.

Thus it is an object of the invention to provide a method of the type referred to above which does not suffer from the drawbacks mentioned previously.

Thus the method according to the invention is characterised by applying a drilling device around said construction in the seabed, making a drill hole to a certain depth with said drilling device, and at a desired depth cutting of the construction using a cutting device lowered into said drill hole.

In correspondance with the method according to the invention a hole is drilled into the seabed surrounding the construction, whereafter the construction is cut from the outside using a cutting device lowered in the hole. In this way all constructions become accessable, irrelevant whether these are internally provided with an obstacle or closing device.

Preferably the method according to the invention is characterised by gripping of the construction above the cutting location using a clamping device and, after cutting, lifting the construction part cut loose. When the uppermost part of the construction is cut loose it can immediately be lifted and removed. Futher the clamping device can secure the cutting device relative to the construction during cutting.

In this aspect it is advantageous if the construction part cut loose is lifted together with the drilling device. Like this the drilling device and the cut loose construction part can be removed in one single step. As a result it is possible to substantially reduce the required time for removing the drilling device and construction part cut loose.

The invention further relates to an apparatus for removing the uppermost part of a construction in the seabed, such as well heads, drilling rig legs and alike. This apparatus is characterised by a drilling device applicable around said construction for drilling in the seadbed to a certain depth and a cutting device connected to said drilling device for cutting the construction from the outside.

Preferably the apparatus is characterised by a clamping device for clamping said drilling device and said cutting device onto the construction. During drilling the drill hole and after cutting the construction said clamping device can stabilize the apparatus relative to the construction. Further said clamping device can be used for lifting the construction part cut loose.

Preferabbly the clamping device comprises at least two clamping assemblies positioned at some distance one above the other. Initially the lowermost clamping assembly will engage the construction to be removed; after the apparatus is moved downward far enough around the construction also the second clamping assembly will engage the construction, thereby properly centering the apparatus according to the construction.

Further a special embodiment of the apparatus according to the invention is mentioned, according to which driving means are provided interpositioned between the drilling device at one hand and the clamping device at the other hand for varying the mutual distance between the drilling device and the clamping device. When the clamping device engages the construction the driving means can increase the distance between the clamping device and the drilling device, such as to drive the drilling device into the seabed. After the driving means have reached there maximum stroke, the clamping device can be deactivated, the distance between the during device and clamping device can be decreased, during which the clamping device is lowered relative to the construction, and the clamping device can be re-activated in its new position, such that the driving means drive the drilling apparatus further into the seabed.

The cutting device can comprise a wire cutting device, of a type known per se.

For example such a wire cutting device can com-

prise a diamant wire. The wire cutting device has to be moved through the construction. To achieve that it is constructively possible that the wire cutting device is in such a way connected pivotably with the apparatus that the operative part of the wire cutting device is movable substantially transversally to the construction to be cut.

Further it is preferred that the cutting apparatus is connected with the apparatus in a detachable manner and is removable therefrom. Like this the cutting device can be removed quickly from the apparatus for the change of worn out parts, such as the diamant wire. For again positioning the apparatus into the cutting device appropiate fastly acting connecting and guiding means may be applied.

The drilling device provided in the apparatus may comprise a rotating drill head known per se for application in drilling tunnels or alike. The provisions required for application of such a drill head are clear for an expert and thus do not need further explication.

For a good operation of the apparatus it further may be of importance that immediately following said drilling device, an enclosure follows which defines the outer limit of the apparatus. Such an enclosure can be shaped as a tube. Said enclosure will protect the drill hole made by the drill head against the entrance of material originating from the surrounding seabed and sea water, thus creating a stable working space around the construction to be removed.

Finally it is noted, that the apparatus can be suspended from a hoisting device on a ship, drilling rig or alike. In this manner it is possible to operate with the apparatus without the application of divers. The required techniques for a remote control of the different parts of the apparatus are known per se and will not be commented further here.

Hereinafter the invention will be illucidated referring to the drawing.

The single figure shows schematically an embodiment of the apparatus according to the invention in a cut away side elevational view.

The figure shows a well head 1 present in the seabed 2. Of said well head 1 the uppermost part, up to a certain depth below the level of the seabed (for example 6 meters) has to be removed. As appears initially an uppermost end of the well head 1 projects above the level of the seabed 2.

At its foremost (or lowermost) end the apparatus for removing the uppermost part of the well head 1 comprises a drilling device 3. In a way known per se said drilling device can comprise a rotating drill head, as applied in drilling tunnels. For the sake of clarity the driver means of a such drill head are not represented. Neither are the supply and discharge lines for drilling mud and control lines represented.

Immediately following the drilling device 3 an enclosure 4 follows which defines the outer limit of the apparatus. Said enclosure takes care that a drill hole made by the drilling devices 3 is not filled with material originating from the seabed 2 or seawater, respectively. The apparatus further comprises two clamping assemblies 5 and 6 which are positioned at some distance one above the other. The clamping assemblies 5, 6 can engage the well head 1 and as a result secure the apparatus thereto. The driving means of the clamping assemblies 5, 6 are schematically represented by dotted lines 7, 8. Of course several posibilities exsist of constructively realising said clamping assemblies 5, 6.

A further essential part of the apparatus is a cutting device 9. In the embodiment illustrated the cutting device comprises a cage 10 positioned around the well head 1. A yoke 11 is suspended in the cage pivotable around a horizontal pivot axis 12. A cylinder-piston-assembly 13 is with its one end connected to the cage 10 and with its other end to the end of the yoke 11 opposite to the pivot axis 12.

Guiding wheels 14 are mounted on the yoke 11 and lead a diamant wire 15 of a wire cutting device. The lowermost part of the diamant wire 15 is longer than the diameter of the well head 1 and extends transversally to the well head 1 and perpendicularly to the plane of the drawing. When the cylinder-piston-assembly 13 is activated and the yoke 11 is pivoted said lowermost part of the diamant wire 15 follows a track indicated by the dotted line 16 (having the pivot axis 12 as center point). In this manner the well head can be cut.

The cutting device 9 is with its cage 10 positioned in guides 17, such that the entire cutting device can be removed quickly from the apparatus when certain parts (such as the diamant wire 15) should be changed because of wear.

Finally the illustrated apparatus comprises driving means 18 interpositioned between the drilling device 3 (or the enclosure joining to it) at one hand and the lowermost clamping assembly 5 at the other hand, using which the distance between the drilling device 3 and the clamping assembly 5 can be varied. By way of example such variation of the distance appears from the different position 3' of the drilling device.

The apparatus operates as follows:
using a hoisting device which can be positioned on board of a ship, the apparatus is lowered by means of a hoisting cable connected to an eye 19. Like this the lowermost part of the apparatus will be positioned with its drilling device 3 around the part of the well head 1 projecting above the seabed 2.

After the apparatus has been positioned around the projecting well head part the clamping assembly 5 is activated and the apparatus will be substantially secured relative to the well head 1. Next the drilling device 3 is activated while also the driving means 18 are activated. As a result the drilling device 3 (drill head) is driving into the seabed 2 as a result of which a drill hole is made around the well head 1. The enclosure 4 prevents that surrounding material (originating from seabed or seawater) enters the created drill hole.

When the driving means 18 (which can comprise cylinder-piston-assemblies) have reached the end of their stroke the clamping assembly 5 is deactivated and

the driving means 18 are moved back towards their starting position. As a result the apparatus moves downward.

Next the clamping assembly can be re-activated and the cycle starts again.

When the apparatus like this has entered the seabed in a predetermined amount also the uppermost clamping assembly 6 reaches the well head 1 and can operate in correspondance with clamping assembly 5. Further, as a result of the cooperation between the clamping assemblies 5 and 6 a good centering and lining out of the apparatus relative to the well head 1 is obtained.

In this manner the apparatus is driven into the seabed 2 around the well head 1 upto the desired depth. Next the cutting device 9 can be activated, as a result of which the diamant wire 15 cuts the well head in correspondance with the track indicated by the dotted line 16 (during activation of the cylinder-piston-assembly 13).

Finally the lowermost clamping assembly 5 can be deactivated again and the apparatus can be lifted using the hoisting cable attached to eye 19. The uppermost part of the well head 1 cut loose is secured by means of the clamping assembly 6 and is lifted thereby.

As appears from the above the clamping assemblies 5, 6 have a multiple function. During operation of the drilling device 3 they can take on vertical forces. During drilling the drill hole the clamping assemblies 5, 6 further take on rotational forces for preventing a rotation of the apparatus around the well head 1. Further they stabilize the apparatus when, using the cutting device 9, the uppermost well head part 1 is cut loose. Further especially the uppermost clamping assembly 6 is fit for lifting the uppermost well head part cut loose.

The invention is not limited to the embodiment described before, which can be varied widely within the scope of the invention as determined by the claims. Thus, the expressions "drilling device" and "cutting device" should be considered in a wide sense as devices which are fit for making a hole in the seabed and for separating the construction part to be removed from the remaining construction part, respectively.

Claims

1. Method for removing the uppermost part of a construction in the seabed, such as well heads, drilling rig legs and alike, **characterised** by applying a drilling device around said construction in the seabed, making a drill hole to a certain depth with said drilling device, and at a desired depth cutting of the construction using a cutting device lowered into said drill hole.

2. Method according to claim 1, **characterised** by gripping of the construction above the cutting location using a clamping device and, after cutting, lifting the construction part cut loose.

3. Method according to claim 2, **characterised in that** the construction part cut loose is lifted together with the drilling device.

4. Apparatus for removing the uppermost part of a construction in the seabed, such as well heads, drilling rig legs and alike, **characterised** by a drilling device applicable around said construction for drilling in the seadbed to a certain depth and a cutting device connected to said drilling device for cutting the construction from the outside.

5. Apparatus according to claim 4, **characterised** by a clamping device for clamping said drilling device and said cutting device onto the construction.

6. Apparatus according to claims 5, **characterised** in that the clamping device comprises at least two clamping assemblies positioned at some distance one above the other.

7. Apparatus according to claim 5 or 6, **characterised** by driving means interpositioned between the drilling device at one hand and the clamping device at the other hand for varying the mutual distance between the drilling device and the clamping device.

8. Apparatus according to claim 7, **characterised** in that the driving means comprise cylinder-piston-assemblies.

9. Apparatus according to one of the claims 4 - 8, **characterised** in that the cutting device comprises a wire cutting device.

10. Apparatus according to claim 9, **characterised** in that the wire cutting device is in such a way connected pivotably with the apparatus that the operative part of the wire cutting device is movable substantially transversally to the construction to be cut.

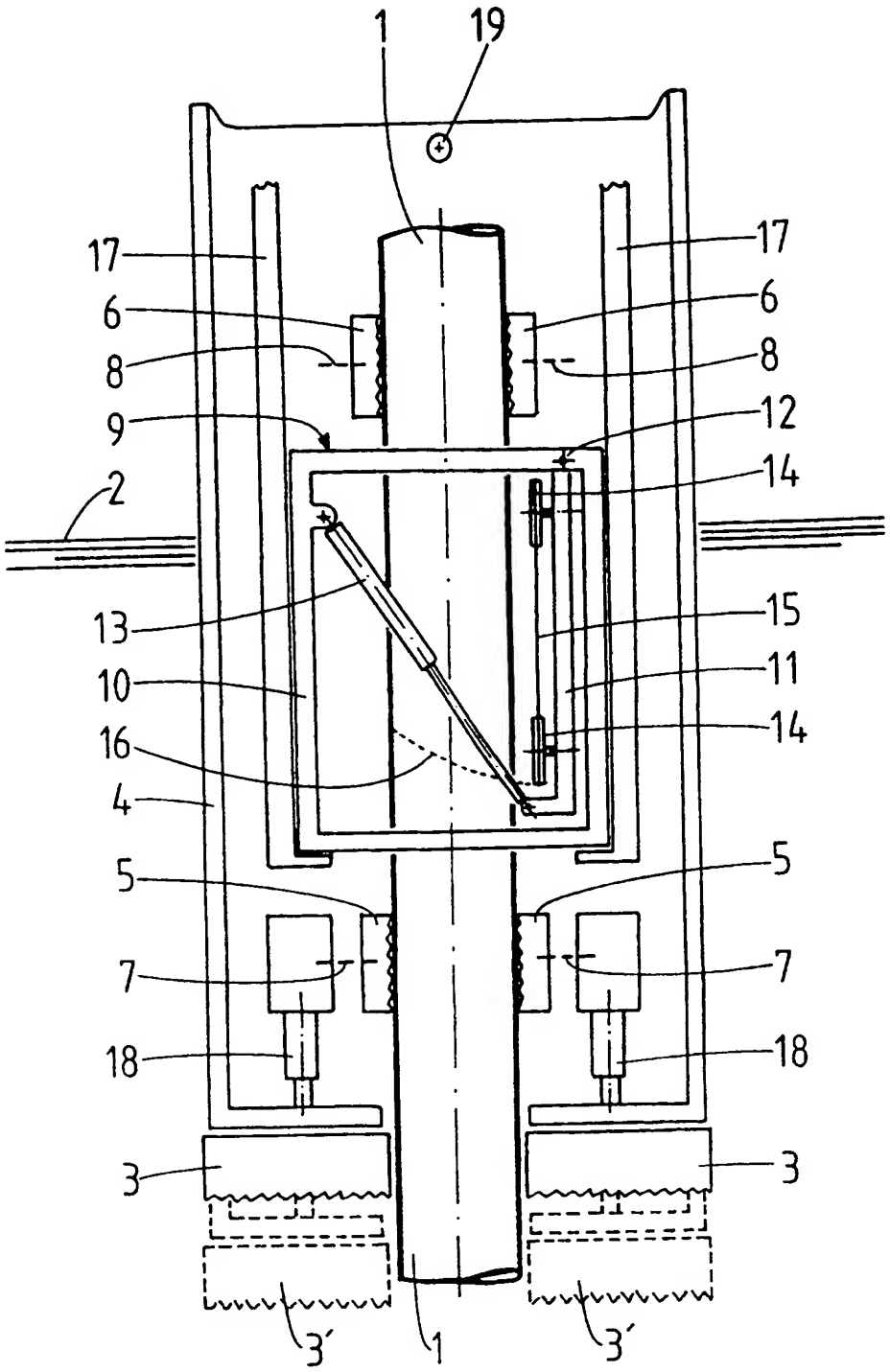
11. Apparatus according to one of the claims 4 - 10, **characterised** in that the cutting apparatus is connected with the apparatus in a detachable manner and is removable therefrom.

12. Apparatus according to one of the claims 4 - 11, **characterised** in that the drilling device comprises a rotating drill head known per se for application in drilling tunnels or alike.

13. Apparatus according to one of the claims 4 - 12, **characterised** in that, immediately following said drilling device, an enclosure follows which defines the outer limit of the apparatus.

14. Apparatus according to one of the claims 4 - 13,

characterised in that it is suspended from a hoisting device on a ship, drilling rig or alike.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